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# I.

# OBSERVATIONS OF THE MEAN RIGHT ASCENSION OF CERTAIN POLAR STARS, MADE AT THE FIELD MEMORIAL OBSERVATORY OF WILLIAMS COLLEGE, AND REDUCED TO THE EPOCH 1884.0.

By Truman Henry Safford.

Presented April 14, 1886.

The observations here presented were made mostly in 1884; a few earlier were not before reduced, for reasons of convenience; and a very few later, in 1885, are here added for completeness' sake.

The latter portion of the observations of 1884, not here given, and those of 1885, are in progress of reduction to 1885.0, and will be offered to the Academy later. The present series includes right ascensions only, as with the instrument here employed it is not convenient to observe both co-ordinates of so close polars at the same time. The region in which I am at present working allows this simultaneous observation. The declinations of the stars here given are readily observed along with both right ascensions and declinations of the stars now taken.

The series of which this work is a part was begun in 1882, at the Field Memorial Observatory of Williams College. The results of 1882–83 are given in the Proceedings, Vol. XIX. pp. 324–352. My intention was and is to carry it over a pretty extensive region of the heavens, taking in from time to time stars needing observation, and those only. This condition, it is true, offers a wide range of choice; but the attempt is made to avoid needless duplication of the work of others. A previous series of right ascensions, which I observed in 1862–66 at Cambridge, was not found superfluous.

Both then and now I have been impressed with certain deficiencies in our fundamental catalogues, as, indeed, have other astronomers. These deficiencies are not the fault of those who have constructed the catalogues, but arise from the lack of foresight in the astronomers of the last century. Our fundamental and secondary places are perfectly good and sure, taken as a whole, for 1865 or thereabouts; but in many cases accurate proper motions are lacking to bring them up to the present epoch. Stars which Bradley observed with sufficient completeness about 1755 can be accurately brought up by proper motions derived from his observations.

But Bradley could not foresee what observers would need a century or more after his decease; and omitted to provide us all the materials we now need, especially in this polar region. The next set of observers — Piazzi, Groombridge, etc. — did not employ stellar observations for the correction of their instruments, but meridian marks; and depended upon occasional adjustments, overlooking the tendency now so well known of instruments to crawl away from their adjustments through molecular strains connected with change of temperature. Consequently, when Bradley, 1755, fails us, the observations of Struve, beginning in 1814, are the first which really come up to Bradley's standard.

So that in my use of the best fundamental catalogue now existing, that of the Astronomische Gesellschaft, I have thought it safest to begin by excluding for instrumental corrections all stars whose proper motions do not essentially depend upon Bradley, or upon Struve and later observers. This excludes quite a number of the right ascensions even of the Hauptsterne; as well those whose errors Professor Rogers and Mr. Chandler have detected, as those which, equally uncertain *a priori*, are approximately correct by compensation of errors. In their places I have substituted a number of closer polars whose right ascensions are thoroughly well determined by modern observations, and whose proper motions are also accurately known. In collecting modern observations, my own Harvard catalogue of 1865, and the work since done there by Professor Rogers, as well as the Williamstown observations, have been added to the ordinary catalogues; and I have sought out and reduced the single Pulcova observations made in this region by Winnecke and Gromadski between 1858 and 1869.

The right ascensions so obtained are amply sufficient both in quantity and quality to replace the excluded "Hauptsterne," although not quite equal to the latter for their own proper epoch, 1865. The greater nearness of these stars to the pole in certain right-ascensions renders them better for instrumental errors than, for example, such as $\gamma$ Ursæ Minoris, whose right ascension is both uncertain and erroneous at the present time; and in fact better than $\zeta$ Ursæ Minoris, which is some degrees nearer, equally uncertain, but actually not quite so much in error, so far as I can judge.

It has not been yet necessary to employ any stars whose right ascensions are not given in one or more ephemerides; so that the following corrections to the apparent places of these ephemerides are currently employed to bring the instrumental corrections into harmony with the Pulcova system, as modified by Auwers.

Two of Auwers's right ascensions are also corrected; Draconis 1 H., as stated in my previous paper; and 76 Draconis, in consequence of an error of sign in the proper motion, which has been since corrected in the Jahrbuch.

| | | s. | s. | |
|---|---|---|---|---|
| Groombridge 944 | American Ephemeris | —0.38 | —0.011 | (*t* — 1885) |
| Camelopardali 25 H. | American Ephemeris | —0.58 | —0.008 | (*t* — 1885) |
| Groombridge 1119 | Connaissance des Temps | +6.1 | +0.32 | (*t* — 1885) |
| Draconis 1 H. | Berliner Jahrbuch | +0.26 | +0.0097 | (*t* — 1885) |
| Bradley 1672 | Conn. des Temps | +1.6 | +0.063 | (*t* — 1885) |
| Camelopardali 32 H. | American Ephemeris | —0.30 | —0.009 | (*t* — 1885) |
| Groombridge 2283 | Conn. des Temps | —2.2 | —0.089 | (*t* — 1885) |
| Bradley 2701 | Montsouris Ephemeris | +0.2 | +0.008 | (*t* — 1885) |
| 76 Draconis | B. J. (to 1886 inclusive) | +0.366 | +0.0282 | (*t* — 1885) |
| Groombridge 3548 | Conn. des Temps | —0.76 | —0.017 | (*t* — 1885) |
| Cephei 32 H. | Montsouris Ephemeris | 0. | | |
| Cephei 39 H. | Conn. des Temps | 0. | | |

In extending my scheme southward, I have, as will be seen, inserted the doubtful Hauptsterne, and all the Zusatzsterne, so far as my zone now goes, into my working list. The doubt refers almost exclusively to right ascension; hence this co-ordinate will be determined, while at present the catalogue declination is used to find the equator-point.

During the present year I hope to begin a series of experiments with the Rittenhouse* collimator, for the purpose of showing how far

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* It seems to be certain that our countryman, David Rittenhouse, was the first to employ an object-glass of small curvature with a meridian mark in its focus. It is quite possible that this application preceded that of an ordinary telescope as a collimator; but the latter is practically a different instrument.

I can depend upon the stability of the soil in the Observatory grounds. This collimator has an object-glass of five inches in diameter mounted upon a pier south of the circle; on the same pier are Y's for the other collimator, and the object-glass is between them, but can be turned down so that the telescope of two and one half inches' aperture can be placed in the Y's over it. The telescope, which has pivots and a level, is usually placed upon the north collimator pier, which has Y's, but no object-glass.

In the ordinary position, then, we have two collimators which can be set upon each other; the focal mark is one hundred Paris feet south of the five-inch object-glass, and the north collimator has an excellent micrometer.

When the north collimator telescope is transferred to the south Y's, it can be used with its level for the determination of the horizontal point, as well as in its usual position.

The whole arrangement is ingenious, original, and economical, and admirably adapted to an observatory whose means are insufficient for strictly primary work, while, with the addition of a few not very expensive auxiliaries, it can be readily adapted to primary work. The object-glass and eye-piece are interchangeable, a requirement which I should always make for any fixed instrument, (I believe the Repsolds always construct their large instruments so,) and there is no difficulty whatever in observing the nadir whenever we please.

But at present I have no intention of attempting a strictly primary catalogue; enough such catalogues are now in course of construction, and I need only to take care that the casual errors of the primary catalogue which I employ do not become systematic errors in my results. Of this there is some danger when the Jahrbuch in its present condition is employed without discriminating between well and ill determined polars, — that is, without reading Professor Auwers's memoir.

The general arrangement of the tables which follow is like that in my previous paper, Vol. XIX. of the Proceedings, pages 324–352. The mean right ascensions are given in two different ways, according as their places are or are not given in one of the great ephemerides. In the former case the datum of each observation is the correction to the ephemeris; and the mean right ascensions for 1884.0 are obtained by applying to that given in the ephemeris the mean of these corrections. For other stars no proper motions are here applied.

As the observations reduced to 1885.0 will soon follow these, I have thought it needless to form a catalogue of mean right ascensions for this paper.

## MEAN RIGHT ASCENSIONS FOR 1884.0.

*Results of Separate Observations.*

### GROOMBRIDGE 67.

| | h. | m. | s. |
|---|---|---|---|
| 1884, May 2 s. p. | 0 | 24 | 50.18 |
| 3 s. p. | | | 51.04 |
| 24 s. p. | | | 50.30 |
| 28 s. p. | | | 50.03 |
| Nov. 21 | | | 50.65 |
| 22 | | | 51.38 |
| 29 | | | 50.27 |
| Dec. 2 | | | 50.64 |
| Mean A. R. 1884.0 | 0 | 24 | 50.561 |

### RADCLIFFE 134.

| | h. | m. | s. |
|---|---|---|---|
| 1884, Dec. 2 | 0 | 28 | 32.22 |
| 4 | | | 32.50 |
| 29 | | | 32.33 |
| 30 | | | 32.52 |
| Mean A. R. 1884.0 | 0 | 28 | 32.392 |

### SCHWERD 43.

| | h. | m. | s. |
|---|---|---|---|
| 1884, Nov. 15 | 0 | 51 | 13.42 |
| 22 | | | 13.76 |
| 29 | | | 13.49 |
| Dec. 2 | | | 13.44 |
| Mean A. R. 1884.0 | 0 | 51 | 13.528 |

### BRADLEY 95.

| | h. | m. | s. |
|---|---|---|---|
| 1882, Oct. 20 | 0 | 56 | 46.11 |
| 1884, Jan. 10 | | | 46.75 |
| 12 | | | 46.58 |
| 17 | | | 47.01 |
| Mean A. R. 1884.0 | 0 | 56 | 46.612 |

### RADCLIFFE 378.

| | h. | m. | s. |
|---|---|---|---|
| 1884, May 28 s. p. | 1 | 8 | 37.05 |
| Nov. 15 | | | 36.81 |
| 29 | | | 37.03 |
| Dec. 2 | | | 36.91 |
| 4 | | | 36.27 |
| Mean A. R. 1884.0 | 1 | 8 | 36.814 |

### BRADLEY 402.

| | h. | m. | s. |
|---|---|---|---|
| 1883, June 22 s. p. | 3 | 5 | 2.12 |
| 23 s. p. | | | 2.20 |
| 1884, June 26 s. p. | | | 2.64 |
| July 3 s. p. | | | 3.29 |
| 7 s. p. | | | 2.82 |
| 10 s. p. | | | 2.80 |
| Mean A. R. 1884.0 | 3 | 5 | 2.645 |

### GROOMBRIDGE 848.

| | | h. | m. | s. |
|---|---|---|---|---|
| 1884, July 18 s. p. | B. J. | | | +0.04 |
| 21 s. p. | | | | +0.00 |
| 22 s. p. | | | | +0.10 |
| 25 s. p. | | | | —0.09 |
| | Mean | | | +0.012 |
| | B. J. | | | 14.581 |
| Mean A. R. 1884.0 | | 4 | 33 | 14.593 |

### RADCLIFFE 1272.

| | h. | m. | s. |
|---|---|---|---|
| 1884, July 9 s. p. | 4 | 40 | 28.13 |
| 10 s. p. | | | 28.49 |
| 11 s. p. | | | 28.23 |
| 15 s. p. | | | 28.03 |
| Mean A. R. 1884.0 | 4 | 40 | 28.220 |

### RADCLIFFE 1311.

| | h. | m. | s. |
|---|---|---|---|
| 1884, July 21 s. p. | 4 | 50 | 48.17 |
| 22 s. p. | | | 48.22 |
| 25 s. p. | | | 47.34 |
| 26 s. p. | | | 47.98 |
| Mean A. R. 1884.0 | 4 | 50 | 47.928 |

### GROOMBRIDGE 966.

| | | h. | m. | s. |
|---|---|---|---|---|
| 1884, July 18 s. p. | B. J. | | | +0.04 |
| 22 s. p. | | | | +0.45* |
| 25 s. p. | | | | +0.04 |
| 28 s. p. | | | | —0.13 |
| | Mean | | | +0.100 |
| | B. J. | | | 13.185 |
| Mean A. R. 1884.0 | | 5 | 24 | 13.285 |

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* The observation of July 22 seems anomalous; but no error can be found in the wires or reductions. The air was thick, and the star probably faint and tremulous.

## MEAN RIGHT ASCENSIONS FOR 1884.0. — *Continued.*

### GROOMBRIDGE 944.

| | | | h. | m. | s. |
|---|---|---|---|---|---|
| 1884, Feb. 1 | | A. E. | | | —0.72 |
| 15 | | | | | —0.71 |
| July 18 | s. p. | | | | —0.03 |
| 21 | s. p. | | | | —0.17 |
| 22 | s. p. | | | | +0.11 |
| 25 | s. p. | | | | —0.40 |
| Aug. 14 | s. p. | | | | —0.06 |
| 16 | s. p. | | | | —0.18 |
| 18 | s. p. | | | | —0.18 |
| | | Mean | | | —0.260 |
| | | A. E. | | | 56.518 |
| Mean A. R. 1884.0 | | | 5 | 24 | 56.258 |

### GROOMBRIDGE 956.

| | | h. | m. | s. |
|---|---|---|---|---|
| 1883, Aug. 14 | s. p. | 5 | 29 | 32.75 |
| 21 | s. p. | | | 33.27 |
| 22 | s. p. | | | 33.02 |
| 1884, July 21 | s. p. | | | 33.43 |
| 25 | s. p. | | | 33.56 |
| 28 | s. p. | | | 33.73 |
| 30 | s. p. | | | 33.29 |
| Mean A. R. 1884.0 | | 5 | 29 | 33.293 |

### GROOMBRIDGE 1004.

| | | h. | m. | s. |
|---|---|---|---|---|
| 1884, Feb. 1 | | 6 | 0 | 55.19 |
| 15 | | | | 55.81 |
| July 30 | s. p. | | | 55.85 |
| Aug. 2 | s. p. | | | 55.48 |
| 14 | s. p. | | | 54.84 |
| 15 | s. p. | | | 54.68 |
| Mean A. R. 1884.0 | | 6 | 0 | 55.308 |

### CAMELOPARDALI 23 H.

| | | h. | m. | s. |
|---|---|---|---|---|
| 1884, Feb. 1 | B. J. | | | —0.35 |
| 15 | | | | —0.33 |
| Mar. 4 | | | | —0.21 |
| 18 | | | | —0.04 |
| 22 | | | | —0.18 |
| | Mean | | | —0.222 |
| | B. J. 1884.0 | | | 24.996 |
| Mean A. R. 1884.0 | | 6 | 26 | 24.774 |

### CAMELOPARDALI 25 H.

| | | h. | m. | s. |
|---|---|---|---|---|
| 1884, Feb. 15 | A. E. | | | —0.37 |
| Mar. 4 | | | | —0.82 |
| 18 | | | | —0.96 |
| 22 | | | | —0.78 |
| | Mean | | | —0.732 |
| | A. E. | | | 36.827 |
| Mean A. R. 1884.0 | | 7 | 6 | 36.095 |

### SCHWERD 406.

| | h. | m. | s. |
|---|---|---|---|
| 1884, Feb. 15 | 7 | 9 | 26.92 |
| Mar. 4 | | | 26.25 |
| 18 | | | 26.67 |
| 22 | | | 26.70 |
| 25 | | | 26.62 |
| Mean A. R. 1884.0 | 7 | 9 | 26.632 |

### GROOMBRIDGE 1278.

| | h. | m. | s. |
|---|---|---|---|
| 1884, Feb. 15 | 7 | 13 | 28.81 |
| Mar. 4 | | | 28.47 |
| 18 | | | 28.61 |
| 22 | | | 28.76 |
| 25 | | | 28.73 |
| Mean A. R. 1884.0 | 7 | 13 | 28.676 |

### GROOMBRIDGE 1119.

| | | h. | m. | s. |
|---|---|---|---|---|
| 1884, Mar. 15 | C. des T. | | | +6.46 |
| 18 | | | | +6.76 |
| 22 | | | | +4.26 |
| 25 | | | | +4.45 |
| | Mean | | | +5.482 |
| | C. des T. | | | 48.39 |
| Mean A. R. 1884.0 | | 7 | 39 | 53.872 |

### RADCLIFFE 2020.

| | | h. | m. | s. |
|---|---|---|---|---|
| 1884, Mar. 22 | | 7 | 47 | 5.39 |
| 25 | | | | 5.86 |
| Aug. 27 | s. p. | | | 6.02 |
| Sept. 2 | s. p. | | | 5.89 |
| Mean A. R. 1884.0 | | 7 | 47 | 5.790 |

## MEAN RIGHT ASCENSIONS FOR 1884.0. — *Continued.*

### GROOMBRIDGE 1391.

| | h. | m. | s. |
|---|---|---|---|
| 1884, Mar. 15 | 8 | 1 | 59.07 |
| 18 | | | 58.63 |
| 25 | | | 59.19 |
| 31 | | | 58.99 |
| Mean A. R. 1884.0 | 8 | 1 | 58.970 |

### RADCLIFFE 2162.

| | h. | m. | s. |
|---|---|---|---|
| 1884, Sept. 2 s. p. | 8 | 31 | 46.05 |
| 5 s. p. | | | 45.61 |
| 9 s. p. | | | 45.51 |
| 17 s. p. | | | 45.93 |
| Mean A. R. 1884.0 | 8 | 31 | 45.775 |

### GROOMBRIDGE 1463.

| | h. | m. | s. |
|---|---|---|---|
| 1883, Apr. 13 | 8 | 38 | 25.06 |
| 14 | | | 25.75 |
| Oct. 5 s. p. | | | 25.47 |
| 1884, Mar. 25 | | | 25.21 |
| 31 | | | 25.29 |
| Sept. 9 s. p. | | | 25.04 |
| 12 s. p. | | | 25.45 |
| 17 s. p. | | | 25.72 |
| 18 s. p. | | | 25.72 |
| Mean A. R. 1884.0 | 8 | 38 | 25.412 |

### RADCLIFFE 2189.

| | h. | m. | s. |
|---|---|---|---|
| 1884, Sept. 5 s. p. | 8 | 42 | 23.62 |
| 9 s. p. | | | 23.58 |
| 12 s. p. | | | 23.92 |
| 17 s. p. | | | 24.21 |
| Mean A. R. 1884.0 | 8 | 42 | 23.832 |

### RADCLIFFE 2368.

| | h. | m. | s. |
|---|---|---|---|
| 1884, Nov. 10 s. p. | 9 | 39 | 9.86 |
| 21 s. p. | | | 9.85 |
| 22 s. p. | | | 10.39 |
| 24 s. p. | | | 9.61 |
| Mean A. R. 1884.0 | 9 | 39 | 9.928 |

### SCHWERD 587.

| | h. | m. | s. |
|---|---|---|---|
| 1884, Apr. 22 | 9 | 44 | 48.90 |
| 23 | | | 48.82 |
| 26 | | | 49.39 |
| Nov. 10 s. p. | | | 49.43 |
| Mean A. R. 1884.0 | 9 | 44 | 49.135 |

### SCHWERD 600.

| | h. | m. | s. |
|---|---|---|---|
| 1883, Mar. 22 | 9 | 57 | 18.01 |
| Apr. 14 | | | 17.91 |
| 17 | | | 17.96 |
| 1884, Apr. 22 | | | 18.08 |
| 23 | | | 17.83 |
| 26 | | | 17.86 |
| Nov. 10 s. p. | | | 18.12 |
| 21 s. p. | | | 17.99 |
| 24 s. p. | | | 18.03 |
| Dec. 2 s. p. | | | 18.08 |
| Mean A. R. 1884.0 | 9 | 57 | 17.987* |

### RADCLIFFE 2407.

| | h. | m. | s. |
|---|---|---|---|
| 1884, Oct. 24 s. p. | 9 | 58 | 33.37 |
| Nov. 10 s. p. | | | 34.45 |
| 21 s. p. | | | 32.82 |
| Mean A. R. 1884.0 | 9 | 58 | 33.547 |

### RADCLIFFE 2459.

| | h. | m. | s. |
|---|---|---|---|
| 1883, Oct. 17 s. p. | 10 | 9 | 30.44 |
| 1884, Apr. 22 | | | 29.88 |
| 25 | | | 29.54 |
| 26 | | | 29.83 |
| Nov. 10 s. p. | | | 30.07 |
| 21 s. p. | | | 29.86 |
| 24 s. p. | | | 29.86 |
| Dec. 2 s. p. | | | 29.54 |
| Mean A. R. 1884.0 | 10 | 9 | 29.878 |

### BRADLEY 1458.

| | h. | m. | s. |
|---|---|---|---|
| 1883, Dec. 6 s. p. | 10 | 31 | 58.49 |
| 1884, Apr. 23 | | | 58.43 |
| 26 | | | 58.80 |
| 30 | | | 58.43 |
| May 2 | | | 58.61 |
| Nov. 8 s. p. | | | 58.75 |
| Dec. 2 s. p. | | | 58.74 |
| 4 s. p. | | | 58.70 |
| Mean A. R. 1884.0 | 10 | 31 | 58.619 |

### RADCLIFFE 2612.

| | h. | m. | s. |
|---|---|---|---|
| 1884, Apr. 26 | 11 | 0 | 19.94 |
| May 2 | | | 19.37 |
| 3 | | | 18.91 |
| Nov. 14 s. p. | | | 19.20 |
| 15 s. p. | | | 18.89 |
| Mean A. R. 1884.0 | 11 | 0 | 19.262 |

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* A single observation of 1884 Nov. 22 s. p. gives 1 s. more than the mean of these ten; it was rejected, because at the time a workman was hammering loudly in the observing room, and a miscount of 1 s. may easily have taken place.

## MEAN RIGHT ASCENSIONS FOR 1884.0. — *Continued.*

### SCHWERD 665.

| | | h. | m. | s. |
|---|---|---|---|---|
| 1884, May 2 | | 11 | 0 | 43.96 |
| Nov. 8 | s. p. | | | 44.23 |
| 14 | s. p. | | | 43.50 |
| 15 | s. p. | | | 43.83 |
| Mean A. R. 1884.0 | | 11 | 0 | 43.880 |

### RADCLIFFE 2684.

| | | h. | m. | s. |
|---|---|---|---|---|
| 1884, Nov. 8 | s. p. | 11 | 22 | 52.02 |
| 14 | s. p. | | | 51.85 |
| 15 | s. p. | | | 52.10 |
| 21 | s. p. | | | 52.50 |
| Mean A. R. 1884.0 | | 11 | 22 | 52.118 |

### GROOMBRIDGE 1782.

| | | h. | m. | s. |
|---|---|---|---|---|
| 1884, Apr. 23 | | 11 | 23 | 37.02 |
| 26 | | | | 37.31 |
| May 2 | | | | 37.03 |
| 3 | | | | 36.94 |
| Nov. 14 | s. p. | | | 36.80 |
| 15 | s. p. | | | 36.84 |
| 21 | s. p. | | | 37.02 |
| Dec. 29 | s. p. | | | 37.31 |
| Mean A. R. 1884.0 | | 11 | 23 | 37.034 |

### RADCLIFFE 2705.

| | | h. | m. | s. |
|---|---|---|---|---|
| 1884, Apr. 26 | | 11 | 26 | 44.91 |
| May 2 | | | | 45.36 |
| 3 | | | | 44.63 |
| Nov. 21 | s. p. | | | 45.06 |
| Dec. 30 | s. p. | | | 45.94 |
| Mean A. R. 1884.0 | | 11 | 26 | 45.180 |

### RADCLIFFE 2738.

| | | h. | m. | s. |
|---|---|---|---|---|
| 1884, Nov. 15 | s. p. | 11 | 38 | 51.44 |
| 21 | s. p. | | | 51.85 |
| 29 | s. p. | | | 51.99 |
| Dec. 26 | s. p. | | | 50.78 |
| Mean A. R. 1884.0 | | 11 | 38 | 51.515 |

### GROOMBRIDGE 1845.

| | | h. | m. | s. |
|---|---|---|---|---|
| 1883, Oct. 20 | s. p. | 11 | 54 | 13.73 |
| Nov. 21 | s. p. | | | 13.11 |
| 1884, Apr. 30 | | | | 13.44 |
| May 2 | | | | 13.71 |
| 3 | | | | 13.58 |
| 24 | | | | 13.97 |
| Nov. 21 | s. p. | | | 14.08 |
| 22 | s. p. | | | 13.57 |
| 29 | s. p. | | | 13.63 |
| Dec. 25 | s. p. | | | 13.62 |
| Mean A. R. 1884.0 | | 11 | 54 | 13.644 |

### GROOMBRIDGE 1850.

| | | h. | m. | s. |
|---|---|---|---|---|
| 1884, Apr. 30 | | 11 | 58 | 52.71 |
| May 2 | | | | 53.57 |
| 3 | | | | 53.70 |
| 24 | | | | 54.07 |
| 28 | | | | 54.15 |
| Nov. 14 | s. p. | | | 52.66* |
| 21 | s. p. | | | 53.71 |
| Mean A. R. 1884.0 | | 11 | 58 | 53.510 |

### GROOMBRIDGE 1858 = BRADLEY 3241.

| | | h. | m. | s. |
|---|---|---|---|---|
| 1884, Nov. 14 | s. p. | 12 | 5 | 45.30 |
| 15 | s. p. | | | 45.77 |
| 21 | s. p. | | | 45.72 |
| 22 | s. p. | | | 45.53 |
| 29 | s. p. | | | 45.87 |
| Mean A. R. 1884.0 | | 12 | 5 | 45.638 |

### BRADLEY 1642 (following of two stars).

| | | h. | m. | s. |
|---|---|---|---|---|
| 1884, Nov. 29 | s. p. | 12 | 11 | 9.46 |
| Dec. 2 | s. p. | | | 9.41 |
| 4 | s. p. | | | 9.58 |
| 29 | s. p. | | | 9.71 |
| Mean A. R. 1884.0 | | 12 | 11 | 9.540 |

### BRADLEY 1672.

| | | | | s. |
|---|---|---|---|---|
| 1884, Apr. 30 | C. des T. | | | +1.01 |
| May 2 | | | | +1.70 |
| 3 | | | | +0.31 |
| 24 | | | | +1.76 |
| | Mean | | | +1.195 |
| | C. des T. | | | 18.33 |
| | | h. | m. | s. |
| Mean A. R. 1884.0 | | 12 | 14 | 19.525 |

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* A large political meeting was going on in the neighborhood, with great uproar.

## MEAN RIGHT ASCENSIONS FOR 1884.0. — *Continued.*

### GROOMBRIDGE 1879.

| | h. | m. | s. |
|---|---|---|---|
| 1884, Nov. 8 s. p. | 12 | 15 | 57.31 |
| 14 s. p. | | | 56.82 |
| 21 s. p. | | | 56.52 |
| 22 s. p. | | | 56.62 |
| Mean A. R. 1884.0 | 12 | 15 | 56.818 |

### GROOMBRIDGE 1909.

| | h. | m. | s. |
|---|---|---|---|
| 1882, Nov. 21 s. p. | 12 | 30 | 36.45 |
| 1883, May 17 | | | 35.67 |
| 1884, May 2 | | | 36.25 |
| 3 | | | 36.39 |
| 24 | | | 36.33 |
| 28 | | | 36.35 |
| Nov. 8 s. p. | | | 36.17 |
| 21 s. p. | | | 36.61 |
| 22 s. p. | | | 36.91 |
| 29 s. p. | | | 36.45 |
| Mean A. R. 1884.0 | 12 | 30 | 36.358 |

### SCHWERD 750.

| | h. | m. | s. |
|---|---|---|---|
| 1884, Nov. 21 s. p. | 12 | 33 | 37.52 |
| 22 s. p. | | | 38.21 |
| 29 s. p. | | | 37.58 |
| Dec. 2 s. p. | | | 37.29 |
| Mean A. R. 1884.0 | 12 | 33 | 37.650 |

### SCHWERD 752.

| | h. | m. | s. |
|---|---|---|---|
| 1883, Nov. 7 s. p. | 12 | 34 | 38.02 |
| Dec. 6 s. p. | | | 37.66 |
| 29 s. p. | | | 37.72 |
| 1884, Nov. 8 s. p. | | | 38.99 |
| Mean A. R. 1884.0 | 12 | 34 | 38.098 |

### GROOMBRIDGE 1923.

| | h. | m. | s. |
|---|---|---|---|
| 1884, May 24 | 12 | 37 | 33.93 |
| 28 | | | 33.75 |
| Nov. 8 s. p. | | | 34.11 |
| 14 s. p. | | | 34.07 |
| Mean A. R. 1884.0 | 12 | 37 | 33.965 |

### GROOMBRIDGE 1927.

| | h. | m. | s. |
|---|---|---|---|
| 1884, May 24 | 12 | 41 | 29.37 |
| Nov. 8 s. p. | | | 29.63 |
| Mean A. R. 1884.0 | 12 | 41 | 29.500 |

### SCHWERD 761.

| | h. | m. | s. |
|---|---|---|---|
| 1884, Nov. 14 s. p. | 12 | 41 | 53.46 |
| 15 s. p. | | | 53.44 |
| 21 s. p. | | | 53.86 |
| 22 s. p. | | | 53.59 |
| Mean A. R. 1884.0 | 12 | 41 | 53.588 |

### FEDORENKO 2201.

| | h. | m. | s. |
|---|---|---|---|
| 1884, Nov. 15 s. p. | 12 | 58 | 24.65 |
| 21 s. p. [½ wt.] | | | 25.12 |
| Dec. 2 s. p. | | | 24.56 |
| 4 s. p. | | | 25.03 |
| Mean A. R. 1884.0 | 12 | 58 | 24.800 |

### GROOMBRIDGE 2006.

| | h. | m. | s. |
|---|---|---|---|
| 1884, June 7 | 13 | 6 | 57.42 |
| Mean A. R. 1884.0 | 13 | 6 | 57.420 |

### GROOMBRIDGE 1977.

| | h. | m. | s. |
|---|---|---|---|
| 1884, May 28 | 13 | 11 | 24.01 |
| 30 | | | 24.28 |
| June 7 | | | 24.12 |
| 13 | | | 24.13 |
| Nov. 15 s. p. | | | 24.34 |
| 1885, Jan. 14 s. p. | | | 24.27 |
| 19 s. p. | | | 24.37 |
| Mean A. R. 1884.0 | 13 | 11 | 24.217 |

### SCHWERD 806.

| | h. | m. | s. |
|---|---|---|---|
| 1884, June 7 | 13 | 42 | 23.28 |
| 13 | | | 23.58 |
| 17 | | | 23.61 |
| 18 | | | 23.51 |
| Mean A. R. 1884.0 | 13 | 42 | 23.495 |

### GROOMBRIDGE 2063.

| | h. | m. | s. |
|---|---|---|---|
| 1884, June 7 | 13 | 45 | 41.92 |
| 13 | | | 42.09 |
| 17 | | | 42.14 |
| 18 | | | 41.88 |
| Mean A. R. 1884.0 | 13 | 45 | 42.008 |

## MEAN RIGHT ASCENSIONS FOR 1884.0.— *Continued.*

### Schwerd 812.

| | h. | m. | s. |
|---|---|---|---|
| 1884, June 7 | 13 | 50 | 5.18 |
| 13 | | | 4.86 |
| 17 | | | 4.95 |
| 18 | | | 4.77 |
| Mean A. R. 1884.0 | 13 | 50 | 4.940 |

### Schwerd 817.

| | h. | m. | s. |
|---|---|---|---|
| 1884, June 13 | 13 | 52 | 35.99 |
| 17 | | | 36.26 |
| 18 | | | 36.74 |
| 1885, June 9 | | | 36.43 |
| Mean A. R. 1884.0 | 13 | 52 | 36.355 |

### Groombridge 2099.

| | h. | m. | s. |
|---|---|---|---|
| 1884, June 7 | 14 | 1 | 21.82 |
| 13 | | | 20.73 |
| 17 | | | 21.32 |
| 18 | | | 21.77 |
| Mean A. R. 1884.0 | 14 | 1 | 21.410 |

### 5 Ursæ Minoris.

| | | s. |
|---|---|---|
| 1884, June 7 | A. E. | —0.03 |
| 13 | | +0.04 |
| 17 | | +0.01 |
| 18 | | +0.18 |
| | Mean | +0.050 |
| | A. E. | 46.958 |

| | h. | m. | s. |
|---|---|---|---|
| Mean A. R. 1884.0 | 14 | 27 | 47.008 |

### Schwerd 853.

| | h. | m. | s. |
|---|---|---|---|
| 1882, Dec. 12 s. p. | 14 | 36 | 52.09 |
| 1883, June 14 | | | 51.91 |
| 25 | | | 52.39 |
| 1884, June 13 | | | 52.32 |
| 17 | | | 52.32 |
| 18 | | | 52.54 |
| 21 | | | 52.83 |
| Mean A. R. 1884.0 | 14 | 36 | 52.343 |

### Groombridge 2210.

| | h. | m. | s. |
|---|---|---|---|
| 1884, June 18 | 14 | 52 | 41.11 |
| 26 | | | 40.94 |
| July 10 | | | 41.43 |
| Mean A. R. 1884.0 | 14 | 52 | 41.160 |

### Groombridge 2196.

| | h. | m. | s. |
|---|---|---|---|
| 1884, June 18 | 14 | 58 | 13.90 |
| 21 | | | 14.03 |
| 26 | | | 13.67 |
| July 3 | | | 13.31 |
| Dec. 30 s. p. | | | 13.96 |
| Mean A. R. 1884.0 | 14 | 58 | 13.774 |

### Groombridge 2213.

| | h. | m. | s. |
|---|---|---|---|
| 1884, June 18 | 15 | 3 | 27.30 |
| 26 | | | 27.18 |
| Dec. 30 s. p. | | | 26.89 |
| Mean A. R. 1884.0 | 15 | 3 | 27.123 |

### Groombridge 2283.

| | | s. |
|---|---|---|
| 1884, June 18 | C. des T. | —1.00 |
| 26 | | —2.41 |
| July 7 | | —1.20 |
| 9 | | —1.77 |
| | Mean | —1.595 |
| | C. des T. | 0.52 |

| | h. | m. | s. |
|---|---|---|---|
| Mean A. R. 1884.0 | 15 | 14 | 58.925 |

### Schwerd 916.

| | h. | m. | s. |
|---|---|---|---|
| 1884, June 18 | 15 | 27 | 38.79 |
| 26 | | | 38.47 |
| July 7 | | | 38.94 |
| 9 | | | 38.55 |
| Mean A. R. 1884.0 | 15 | 27 | 38.688 |

### *θ* Ursæ Minoris.

| | h. | m. | s. |
|---|---|---|---|
| 1883, July 18 | 15 | 34 | 53.15 |
| 20 | | | 52.94 |
| 23 | | | 52.59 |
| 1884, June 26 | | | 52.63 |
| July 7 | | | 52.67 |
| 9 | | | 52.71 |
| 10 | | | 52.76 |
| Mean A. R. 1884.0 | 15 | 34 | 52.779 |

## MEAN RIGHT ASCENSIONS FOR 1884.0. — *Continued.*

### GROOMBRIDGE 2286.

| | h. | m. | s. |
|---|---|---|---|
| 1883, Jan. 18 s. p. | 15 | 39 | 33.34 |
| Feb. 12 s. p. | | | 33.20 |
| 1884, June 18 | | | 33 87 |
| July 7 | | | 33.85 |
| 9 | | | 34.10 |
| 10 | | | 33.83 |
| Dec. 30 s. p. | | | 34.11 |
| 1885, Jan. 8 s. p. | | | 34.28 |
| Mean A. R. 1884.0 | 15 | 39 | 33.822 |

### RADCLIFFE 3523.

| | h. | m. | s. |
|---|---|---|---|
| 1884, Jan. 12 s. p. | 16 | 0 | 35.09 |
| 26 s. p. | [½ wt.] | | 34.76 |
| July 11 | | | 35.34 |
| 15 | | | 35.57 |
| 18 | | | 35.02 |
| 21 | | | 36.14 |
| 1885, Jan. 14 s. p. | | | 35.02 |
| 31 s. p. | | | 34.52 |
| Mean A. R. 1884.0 | 16 | 0 | 35.211 |

### GROOMBRIDGE 2320.

| | | h. | m. | s. |
|---|---|---|---|---|
| 1883, July 20 | A. E. | | | +0.22 |
| 24 | | | | +0.38 |
| 1884, July 9 | | | | +0.38 |
| 10 | | | | +0.21 |
| 15 | | | | +0.33 |
| 22 | | | | +0.47 |
| | Mean | | | +0.332 |
| | A. E. | | | 0.350 |
| Mean A. R. 1884.0 | | 16 | 6 | 0.682 |

### 19 URSÆ MINORIS.

| | | h. | m. | s. |
|---|---|---|---|---|
| 1884, July 7 | B. J. | | | +0.21 |
| 9 | | | | —0.24 |
| 10 | | | | —0.14 |
| 11 | | | | +0.16 |
| | Mean | | | —0.002 |
| | B. J. | | | 8.574 |
| Mean A. R. 1884.0 | | 16 | 14 | 8.572 |

### SCHWERD 963.

| | h. | m. | s. |
|---|---|---|---|
| 1884, July 7 | 16 | 8 | 37.87 |
| 9 | | | 38.24 |
| 10 | | | 38.04 |
| 11 | | | 38.19 |
| Mean A. R. 1884.0 | 16 | 8 | 38.085 |

### 20 URSÆ MINORIS.

| | h. | m. | s. |
|---|---|---|---|
| 1884, July 18 | 16 | 15 | 28.00 |
| 21 | | | 27.88 |
| 25 | | | 27.90 |
| 26 | | | 27.95 |
| Mean A. R. 1884.0 | 16 | 15 | 27.932 |

### η URSÆ MINORIS.

| | | h. | m. | s. |
|---|---|---|---|---|
| 1884, July 7 | A.E.(Suppl.) | | | +0.01 |
| 9 | | | | +0.13 |
| 10 | | | | —0.12 |
| 11 | | | | +0.05 |
| | Mean | | | +0.018 |
| | A. E. | | | 54.388 |
| Mean A. R. 1884.0 | | 16 | 20 | 54.406 |

### GROOMBRIDGE 2347.

| | h. | m. | s. |
|---|---|---|---|
| 1884, July 18 | 16 | 22 | 4.77 |
| 21 | | | 4.82 |
| 22 | | | 4.93 |
| 25 | | | 4.82 |
| Mean A. R. 1884.0 | 16 | 22 | 4.835 |

### A DRACONIS.

| | | h. | m. | s. |
|---|---|---|---|---|
| 1884, July 7 | B. J. | | | +0.07 |
| 9 | | | | +0.08 |
| 10 | | | | —0.14 |
| 11 | | | | +0.20 |
| | Mean | | | +0.052 |
| | B. J. | | | 12.737 |
| Mean A. R. 1884.0 | | 16 | 28 | 12.789 |

### GROOMBRIDGE 2372.

| | h. | m. | s. |
|---|---|---|---|
| 1884, July 7 | 16 | 32 | 12.77 |
| 9 | | | 12.85 |
| 10 | | | 12.49 |
| 11 | | | 12.91 |
| Mean A. R. 1884.0 | 16 | 32 | 12.755 |

## MEAN RIGHT ASCENSIONS FOR 1884.0. — *Continued.*

### Groombridge 2373.

| | | h. | m. | s. |
|---|---|---|---|---|
| 1884, July 7 | B. J. | | | +0.13 |
| 9 | | | | —0.03 |
| 10 | | | | —0.24 |
| 11 | | | | +0.28 |
| | Mean | | | +0.035 |
| | B. J. | | | 38.894 |
| Mean A. R. 1884.0 | | 16 | 35 | 38.929 |

### Schwerd 992.

| | h. | m. | s. |
|---|---|---|---|
| 1884, July 18 | 16 | 44 | 30.07 |
| 21 | | | 30.05 |
| 22 | | | 29.90 |
| 25 | | | 30.00 |
| Mean A. R. 1884.0 | 16 | 44 | 30.005 |

### Groombridge 2391.

| | h. | m. | s. |
|---|---|---|---|
| 1884, July 18 | 16 | 48 | 16.94 |
| 22 | | | 16.69 |
| 25 | | | 17.02 |
| 26 | | | 16.86 |
| Mean A. R. 1884.0 | 16 | 48 | 16.878 |

### Radcliffe 3685.

| | h. | m. | s. |
|---|---|---|---|
| 1884, July 18 | 17 | 1 | 48.44 |
| 21 | | | 48.85 |
| 22 | | | 48.91 |
| 25 | | | 48.75 |
| Mean A. R. 1884.0 | 17 | 1 | 48.738 |

### f Draconis.

| | | h. | m. | s. |
|---|---|---|---|---|
| 1884, July 30 | B. J. | | | +0.23 |
| Aug. 2 | | | | +0.14 |
| 14 | | | | +0.07 |
| 18 | | | | —0.11 |
| | Mean | | | +0.082 |
| | B. J. | | | 25.697 |
| Mean A. R. 1884.0 | | 17 | 32 | 25.779 |

### Radcliffe 3749.

| | h. | m. | s. |
|---|---|---|---|
| 1884, July 21 | 17 | 31 | 35.45 |
| 22 | | | 35.49 |
| 25 | | | 35.71 |
| 28 | | | 35.70 |
| Mean A. R. 1884.0 | 17 | 31 | 35.588 |

### Groombridge 2476.

| | h. | m. | s. |
|---|---|---|---|
| 1884, July 21 | 17 | 34 | 54.39 |
| 22 | | | 54.29 |
| 28 | | | 54.38 |
| 30 | | | 54.40 |
| Mean A. R. 1884.0 | 17 | 34 | 54.365 |

### ω Draconis.

| | | h. | m. | s. |
|---|---|---|---|---|
| 1884, Aug. 2 | B. J. | | | —0.07 |
| 14 | | | | +0.04 |
| 15 | | | | 0.00 |
| 18 | | | | —0.15 |
| | Mean | | | —0.045 |
| | B. J. | | | 37.893 |
| Mean A. R. 1884.0 | | 17 | 37 | 37.848 |

### Radcliffe 3798.

| | h. | m. | s. |
|---|---|---|---|
| 1883, Feb. 13 s. p. | 17 | 38 | 26.77 |
| Mar. 1 s. p. | | | 25.95 |
| 5 s. p. | | | 26.57 |
| Aug. 14 | | | 27.15 |
| 21 | | | 26.99 |
| 22 | | | 26.24 |
| 1884, July 18 | | | 26.98 |
| 21 | | | 26.80 |
| 25 | | | 26.57 |
| 28 | | | 26.07 |
| Mean A. R. 1884.0 | 17 | 38 | 26.609 |

### 35 Draconis.

| | | h. | m. | s. |
|---|---|---|---|---|
| 1884, July 28 | B. J. | | | —0.03 |
| 30 | | | | +0.14 |
| Aug. 16 | | | | —0.08 |
| 18 | | | | —0.11 |
| 23 | | | | +0.24 |
| | Mean | | | +0.032 |
| | B. J. | | | 38.592 |
| Mean A. R. 1884.0 | | 17 | 54 | 38.624 |

### Groombridge 2548.

| | h. | m. | s. |
|---|---|---|---|
| 1883, Aug. 14 | 18 | 4 | 21.44 |
| 21 | | | 21.89 |
| 1884, Aug. 2 | | | 21.75 |
| 15 | | | 22.14 |
| 18 | | | 20.60 |
| Mean A. R. 1884.0 | 18 | 4 | 21.564 |

## MEAN RIGHT ASCENSIONS FOR 1884.0. — *Concluded.*

### RADCLIFFE 3900.

| | h. m. s. |
|---|---|
| 1884, July 30 | 18 10 8.03 |
| Aug. 2 | 7.54 |
| 14 | 7.66 |
| 15 | 7.98 |
| Mean A. R. 1884.0 | 18 10 7.802 |

### RADCLIFFE 3903.

| | h. m. s. |
|---|---|
| 1884, Aug. 16 | 18 11 14.79 |
| 18 | 14.38 |
| 20 | 15.22 |
| 23 | 14.87 |
| Mean A. R. 1884.0 | 18 11 14.815 |

### RADCLIFFE 3921.

| | h. m. s. |
|---|---|
| 1883, Aug. 14 | 18 11 3.81 |
| 1884, Aug. 16 | 4.46 |
| 18 | 3.74 |
| 19 | 4.13 |
| Mean A. R. 1884.0 | 18 11 4.035 |

### φ DRACONIS.

| | | s. |
|---|---|---|
| 1884, Aug. 28 | B. J. | —0.02 |
| Sept. 1 | | +0.03 |
| 2 | | —0.05 |
| 4 | | +0.11 |
| | Mean | +0.018 |
| | B. J. | 25.235 |
| | | h. m. s. |
| Mean A. R. 1884.0 | | 18 22 25.253 |

### SCHWERD 1094.

| | h. m. s. |
|---|---|
| 1883, Aug. 14 | 18 24 57.55 |
| 1884, Aug. 19 | 57.76 |
| 20 | 57.89 |
| 23 [½ wt.] | 58.02 |
| 27 | 57.90 |
| Mean A. R. 1884.0 | 18 24 57.802 |

### GROOMBRIDGE 2655.

| | | s. |
|---|---|---|
| 1883, Aug. 14 | B. J. | —0.12 |
| 1884, July 30 | | +0.07 |
| Aug. 14 | | —0.13 |
| 15 | | +0.11 |
| 16 | | 0.00 |
| | Mean | —0.014 |
| | B. J. | 20.928 |
| | | h. m. s. |
| Mean A. R. 1884.0 | | 18 35 20.914 |

### GROOMBRIDGE 2708.

| | h. m. s. |
|---|---|
| 1884, Aug. 18 | 18 38 36.47 |
| 19 | 36.73 |
| 20 | 37.06 |
| 27 | 36.23 |
| Mean A. R. 1884.0 | 18 38 36.622 |

### RADCLIFFE 4165.

| | h. m. s. |
|---|---|
| 1884, Aug. 18 | 18 53 48.33 |
| 27 | 48.20 |
| 28 | 48.56 |
| Sept. 2 | 48.22 |
| Mean A. R. 1884.0 | 18 53 48.328 |

### RADCLIFFE 4253.

| | h. m. s. |
|---|---|
| 1884, Feb. 15 s. p. | 19 6 19.06 |
| Mar. 4 s. p. | 19.67 |
| 25 s. p. | 20.16 |
| Mean A. R. 1884.0 | 19 6 19.630 |

### SCHWERD 1139.

| | h. m. s. |
|---|---|
| 1884, Mar. 22 s. p. | 19 6 21.59 |
| 25 s. p. | 22.15 |
| Aug. 18 | 21.97 |
| 19 | 22.00 |
| 27 | 21.71 |
| 28 | 22.32 |
| Mean A. R. 1884.0 | 19 6 21.957 |

### RADCLIFFE 4313.

| | h. m. s. |
|---|---|
| 1884, Feb. 15 s. p. | 19 16 43.35 |
| Mar. 4 s. p. | 44.08 |
| 22 s. p. | 44.17 |
| 25 s. p. | 43.83 |
| Mean A. R. 1884.0 | 19 16 43.858 |

### CEPHEI 39 H. s. p.

| | | s. |
|---|---|---|
| 1884, Apr. 22 | C. des T. | —0.03 |
| 23 | | +0.07 |
| 26 | | —0.31 |
| 30 | | —0.60 |
| | Mean | —0.218 |
| | C. des T. | 50.26 |
| | | h. m. s. |
| Mean A. R. 1884.0 | | 23 27 50.042 |